view of Matsumura et al. Applicants respectfully traverse the rejection.

As an initial matter, the Advisory Action cites additional art (Forbes and Pankove) for support in its remarks. If the Examiner is relying on this new art to sustain a rejection of the pending claims, Applicants respectfully submit that this constitutes a new ground of rejection, and the finality of the pending rejections should accordingly be withdrawn. See MPEP § 706.07(e).

In response to Applicants' previous arguments, the Office Action states, "[T]he word 'dot' means something that is dot-shaped, not longer in one direction than another, but symmetrically shaped like a dot. In physics, 'quantum dot' designates a 'zero-dimensional" object...If there were a significant difference in dimensions in the three directions of a structure, one would not be able to disregard the differences in dimensions, and one would not therefore be able to consider such a structure as being (approximately) zero dimensional." Applicants respectfully traverse this statement for a number of reasons.

The term "quantum dot" describes a nanostructure that confines electrons and holes in three dimensions. See, for example, http://www.zialaser.com/technology.html, copy attached. Thus, a "quantum dot" is an object itself having three dimensions, and is not "zero-dimensional." In fact, a quantum dot apparently can have a number of three-dimensional shapes, including, but not necessarily limited to, a cylindrical shape such as the quantum dots shown in Chen and newly-cited reference Pankove, and a spherical shape such as the quantum dot shown in newly-cited reference Forbes. Thus, there may be definite size

differences among different directions of a quantum dot, and the Office Action cannot simply cite the use of the term "quantum dot" in Chen as conclusive evidence that its diameter is equal to its thickness.

Furthermore, the Advisory Action continues to rely on FIGs. 8 and 9 of Chen to support its assertion that the quantum dot of Chen has "about the same diameter as thickness". However, this reliance runs contrary to established law, which clearly provides that patent drawings do not define precise proportions of elements and may not be relied on to show particular sizes if the specification is clearly silent on the issue. See MPEP § 2126. If the rejection is sustained, Applicants respectfully request citation in support of the Office Action's statement that a quantum dot necessarily has a diameter equal to its thickness, or citation to a portion of Chen that indicates that FIGs. 8 and 9 are to scale.

For at least the above reasons, Applicants respectfully submit that claims 1, 5, and 8 are allowable over the references of record, including Chen. The claims dependent on claims 1, 5, and 8 are submitted to be allowable for at least the reasons as applied to their respective independent claims, among other reasons. Applicants thus respectfully request reconsideration and withdrawal of the rejection.

For at least the foregoing reasons, Applicants believe that this case is in condition for allowance, which is respectfully requested. The Examiner should call Applicants' attorney if an interview would expedite prosecution.

Respectfully submitted,

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October 4, 2002

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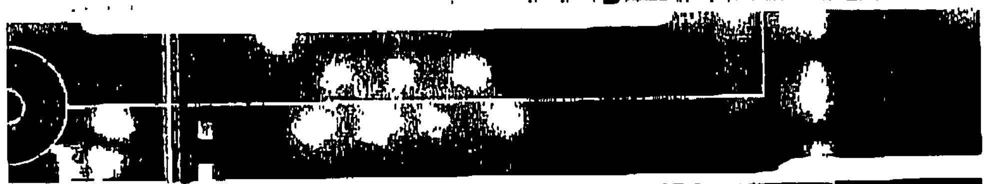

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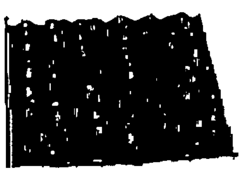

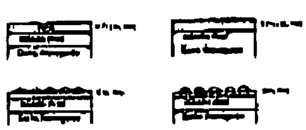

A New Revolution

Now more than ever, fixed and tunable laser module vendors are searching for lower systems cost solutions that offer superior performance than their competitors. This phenomenon spawned the birth of quantum well laser diodes and VCSELs, as both offer distinct cost and performance advantages.

The next step in the evolution of laser diode design has begun; it is the Quantum Dot (QD) Laser. QD lasers will revolutionize the field of semiconductor lasers and eventually replace the current industry standard quantum well lasers. QD lasers offer a lower systems cost solution with superior performance, not achievable with QW lasers for fixed and tunable wavelength solutions.

QD Tutorial

Quantum dots (QD) are semiconductor nanostructures that act as artificial atoms by confining electrons and holes in 3-dimensions. Although named "dots", they are more pyramidal in shape with dimensions of ~200 Å along the base and 70-90 Å in height. In one square centimeter, there are nearly 100 billion dots.

The QDs are formed during Molecular Beam Epitaxy (MBE) growth by a self-assembly method known as the Stranski-Krastanov process. Initial growth layers are grown lattice matched (or coherently strained) to the substrate material. Following the deposition of the active region the subsequent QD layer is then deposited and InAs dots are formed. Completion of the laser structure occurs by subsequently depositing material layers that are lattice matched to the substrate. In fact, other than the QD layer, the preceding and subsequent material layers are really no different than existing semiconductor structures. However, it is these tiny nanostructures that lead the device to a new standard of semiconductor laser performance.

QD Advantages

Due to their unique electronic properties and three-dimensional carrier confinement QD lasers are:

I. Highly Temperature Insensitive

This is due to an ultra low threshold current density that can be attributed in part to the simple scaling of the active region. There is less material to populate with electron-hole pairs in order to establish inversion. A QD laser fabricated by the Zia Laser exhibit threshold current density at 10A/cm2.

II. Extremely Broad Gain Spectrum

A variation in dot size leads to a distribution in the energy levels, and correspondingly, the gain spectrum is broadened s that it extends across the energy states. Because of the ease in which lectron-hole inversion

can be established and because f the rapid gain saturation of th lowest energy state, the higher en rgy levels can be inverted at relatively low current densities. As a result, Zia has demonstrated extremely broad tuning ranges of over 200nm. While such tuning ranges can be obtained in quantum well lasers, the current density required to obtain this range is over 10 times greater.

III. Ultra Low Linewidth

The tremendous benefit to QD lasers is the narrow linewidth, this is a key parameter in the characterization of semiconductor lasers. Zia devices have demonstrated an of 0.1, lasers at 1.55μm is usually greater than 2.

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